

REMARKS

Reconsideration and allowance of the subject application are respectfully requested.

Claims 1-15 are all the claims pending in the application. Applicant submits the pending claims define patentable subject matter.

Independent claim 1 is directed to a liquid crystal optical shutter having an aperture window, and recites, in part:

a first electrode pattern arranged on a first essentially planar substrate,

a second electrode pattern arranged on a second essentially planar substrate, wherein the first and second substrates are provided at a predetermined mutual distance (d), and

liquid crystal material provided between the first and second substrates,

wherein

the first and second electrode patterns each comprises a series of essentially parallel row electrodes,

wherein the series of row electrodes of the first electrode pattern are aligned at an angle of less than 45 degrees with the series of row electrodes of the second electrode pattern so as to create a high internal electrical resistance in series with any point in the liquid crystal optical shutter, whilst maintaining the overall external resistance of the optical shutter at a low level.

Applicant submits that an aspect of the claimed invention provides an optical shutter possessing an aperture window, which is designed so that the optical shutter can be operated with high voltages without electrical sparking (e.g., a short circuit) occurring between the two cell substrates and having the features as defined in the claims. Simultaneously, the electric charge time and the optical response time are not adversely affected.

Applicant further submits that the claimed device is fundamentally different from the devices shown in the cited documents, as these references simply disclose a liquid crystal display (LCD) having a large number of separate picture-elements or pixels, and in such applications, low resistance is desirable to achieve the best optical performance. Problems with short-circuit or electric sparking do not occur in such an application.

For example, Takeda et al. (U.S. Pat. No. 6,078,376; hereinafter "Takeda") discloses an LCD with of a large number of separate picture-elements or pixels that can be individually switched in order to generate a displayed image. It should be noted that the figures in Takeda show a panel structure of a picture element region for one picture element of the LCD, not the entire display. The individual picture-elements of the kind disclosed in Takeda are of the order of size of less than typically one-square-millimeter, so as to give sufficient resolution for the displaying of picture images.

Similarly, Kogyo et al. (JP 2074925A; hereinafter "Kogyo") discloses a crystal display consisting of a large number of separate picture-elements, wherein high-speed electro-optical response is realized by generating a rotating electric field.

Further, Histake et al. (U.S. 5,434,690; hereinafter "Histake") discloses similarly a crystal display consisting of a large number of separate picture-elements, by which an extremely wide viewing angle is obtained.

Therefore, the electrode patterns described in the cited art documents are typically less than 1 mm long and less than 1 mm wide, and cover a single pixel. Consequently, due to the short length of described electrode structures, such patterns do not create a high internal electrical resistance in series with any point in the liquid crystal optical shutter, as defined in the present claims.

The present application discloses an optical shutter with much larger dimensions, for example 400mm x 400mm, possessing a series of essentially parallel row electrodes that can be typically 400mm long with width typically 0.1 mm. In this case, due to the length of said rows, typically 400mm, this patterning will create a high internal electrical resistance in series with any point in the liquid crystal optical shutter.

With regard to the application of electrical voltage to the liquid crystal display disclosed in Takeda, it is noted that in this disclosure the first electrode (on the first substrate) and the third electrode (on the second substrate) have substantially the same potential, and furthermore, a voltage is applied between the first and the third electrodes.

In summary, Applicant submits an aspect of the claimed invention provides an optical shutter, wherein the aperture-window comprises electrode patterns in the form of series of essentially parallel row electrodes so as to create a high internal electrical resistance in series with any point in the liquid crystal optical shutter, whilst maintaining the overall external resistance of the optical shutter at a low level. Applicant submits the prior art of record fails to teach or suggest these unique features.

The geometry of the claimed optical shutter generates an internal electrical resistance such that electrical sparking is prevented from occurring between the two substrates, whilst also maintaining the overall external electrical resistance of the optical-shutter to a low level in order to permit the rapid electrical charging of the optical shutter and hence permit the rapid optical-modulation of said device.

One aspect of the present invention provides an optical shutter that can be operated with high voltages without electrical sparking occurring between the two cell substrates. This is not

addressed in the cited art, wherein the problem to be solved is to provide a liquid crystal display with improved viewing angle or higher speed.

Furthermore, such LCD devices (as in the cited references) comprise a large number of individual pixels that are typically less than one-square-millimeter in size, and wherein the separate pixels are individually switched between two or more optical states in order to create an image. Such geometry fails to generate a high internal electrical resistance as set forth in the present application.

Accordingly, Applicant submits that the cited references fail to disclose or suggest the abovementioned features in an optical shutter, as set forth in independent claim 1. Applicant further submits that dependent claims 2-15 are patentable by virtue of their dependency.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

/Mark C. Davis/

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

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Mark C. Davis
Registration No. 60,552